ASJ: *International Journal of Agricultural Research, Sustainability, and Food Sufficiency (IJARSFS)*
Vol. 4(3) 24 September, 2017, Pp. 174-192
www.academiascholarlyjournal.org/ijarsfs/index_ijarsfs.htm
ISSN: 2360-932X©Academia Scholarly Journals
Indexed In: Directory of Research Journals Indexing - http://www.drji.org
Also Available@; https://archive.org/details/ Mohammed_D_Toungos
Open access

Full Length Research

EFFECT OF BOOST – EXTRA FOLIAR FERTILIZER AND NPK ON GROWTH RATE OF TWO MAIZE (*Zea mays L.*) VARIETIES GROWN IN MUBI, NORTHERN GUINEA SAVANNAH ZONE, NIGERIA

Mohammed Dahiru Toungos

Department of Crop Science, Faculty of Agriculture, Adamawa State University, P.M.B 25, Mubi, Adamawa State, Nigeria

Email: dahiru.tounos@gmail.com

Accepted September 18, 2017

Field experiments conducted in 2011 and 2012 cropping seasons at Food and Agriculture Organization/Tree Crop Programme (FAO/TCP) Teaching and Research Farm, Faculty of Agriculture, Adamawa State University, Mubi, Northern Guinea Savannah zone of Nigeria, to determine the effects of Boost Extra foliar fertilizer and soil applied NPK on growth performance of two maize varieties (Oba 98 and TZESR-W). A split plot design was adopted for the study with varieties as main plots and seven fertility levels as sub-plots. These were combinations of soil-applied NPK and Boost Extra foliar fertilizers (0.0.0 kg/ha NPK + 0 Boost Extra; 120: 60:60 kg/ha NPK + 6 Lha^{-1} Boost Extra; 90:45:45 kg/ha NPK + 6 Lha^{-1} Boost Extra; 60:30:30 kg/ha NPK + 6 Lha^{-1} Boost Extra; 30:15:15 kg/ha NPK + 6 Lha^{-1} Boost Extra; 0:0:0 kgha^{-1} NPK + 6 L/ha^{-1} Boost Extra; 120:60:60 NPK + 6 Lha^{-1} Boost Extra), replicated 3 times. The results revealed that maize characters (plant height, stem girth, shoot dry matter, cob diameter, 100 grain weight) were found to increase with increased application of NPK rate of 90:45:45 kgha^{-1} + 6 Lha^{-1} Boost – Extra foliar fertilizer. It is recommended that application of 90: 45: 45 kgha^{-1} of NPK in combination with 6 Lha^{-1} Boost Extra foliar fertilizers gives best result in maize production in Northern Savannah Zone.

Key words: Maize, varieties, NPK, Boost Extra, Yield, Oba 98, TZESR-W.

INTRODUCTION

Maize is one of the popular and world's leading crops. It is cultivated over land area of 159 million hectares with a worldwide production of 817 million tonnes, more than wheat, (682 million tonnes) or rice, (678 million tonnes) in 2009 (Wikipedia, 2011). United States of America (USA) cultivates the largest area, with highest production among maize growing countries in the world (Onwueme and Sinha, 1991).

Maize was probably found to have been

introduced into Nigeria by the Portuguese in the 16th century (Osagie and Eka, 1998). Today, maize is grown in almost all parts of the country, more than any other cereal crops (Ado et al., 2004). In 2008, Nigeria produced 7.5 million metric tonnes of maize on 4.7 million hectares of land with average yield of 1.6 tha^{1} (FAO, 2008). Guinea Savannah is the largest maize producing zone in Nigeria (CBN, 1992 and FAO, 2003). Maize is a staple food in Nigeria with consumption quantity of 53.2g capital^{-1} day^{-1} (Ayinde et al., 2010), the crop is usually grown in association with other arable crops, especially in Southern parts of Nigeria, but seldom grown as sole crop by farmers in the northern parts. (Kusimo, 2004; Arit et al., 2005; Rhesus, 2006).

Most Nigerian farmers have over the years, relied on shifting cultivation as a means of reclaiming soil fertility. However, with the pressure of increasing population and competing land use, long fallow periods are no longer practicable. Therefore, the shortening of fallow period has led to a decline in soil fertility and optimum maize crop growth performance. Fertilizer application plays a vital role in increased soil fertility and optimum crop growth and yield. Maize takes up NPK from the soil as primary nutrient elements required for growth and development. The requirement for this fertilizer depends upon the fertility status of the soil, previous cropping history and duration of variety to be grown. However, a balanced application of 60 - l20kgNha^{-1}, 40- 60kgPha^{-1} and 40kgKha^{-1} is recommended for various ecosystems for maize in Nigeria (Ado et al., 2004).

Foliar fertilizers are solutions containing high-grade elements combined in a desired ratio. The nutrients are applied to the aerial part of plants and absorbed through the leaf cuticle and the stomata to enter the phloem cells. This provides for rapid nutrient utilization and quick correction of deficiencies compared to soil applied nutrients. The response from foliar fertilizer is however, often temporary due to the small amount of nutrient applied (Havlin et al., 2005). According to them, foliar feeding has been used as supplemental doses of nutrients, plant hormones, stimulants, and other beneficial substances. The observed effects of foliar fertilization included increased growth rate, resistance to diseases and pests, improved drought tolerance, enhanced crop quality and subsequently, yield increase. Plant response is however, dependent on species, fertilizer form, composition, concentration, and frequency of application, as well as the stage of plant growth. Foliar application is found to gives better results at certain and specific vegetative or fruiting stages of growth and the fertilizer composition adjusted accordingly. The main objectives of this study therefore, are to determine the effect of Boost Extra foliar fertilizer complex on maize growth rate and ascertain whether Boost Extra foliar fertilizer complex can be used as a substitute for soil applied NPK fertilizer in maize crop.

MATERIALS AND METHODS

Experimental Site

Two-year field experiments were carried out in 2011 and 2012 cropping seasons at Teaching and Research Farm, Adamawa State University, Mubi South Local Government, Adamawa State (latitude 9^0 30' to 11^0 88'N and longitude $12^0$00, 13^0 45'E), which falls within Northern Guinea Savannah Zone of Nigeria (ADSU Meteorological Unit, 2011). Total annual rainfall during the field trial in 2011 and 2012 were 764.8mm and 1343.lmm, respectively. The peak period of rain in this zone falls between August and September.

Physical and Chemical Properties of Soil of the Experimental Site

A composite soil sample of 1-30cm depth was collected from 8 different portions of the experimental area and its physical and chemical properties were determined as shown in the Table 1.

Meteorological Data

The meteorological data during the field trials in 2011 and 2012 cropping seasons are presented in appendix 1 and 2 respectively; showing the mean annual rainfall, temperature and relative humidity.

Treatments and Experimental Design

The experiment was laid out in a split-plot design. The main treatments consisted of two maize varieties (Oba 98 hybrid and 'TZESR-W') and the sub-treatments comprised seven fertility levels,

Table 1. Physical and Chemical Soil Properties of the Experimental Site, 0-30cm depth.

Chemical	2011	2012
Particle size analysis (%)		
Sand	53 .4	54. 1
Silt	32.2	3 1 .9
Clay	1 3 .4	14.0
Texture	Sandy loam	Sandy loam
Chemical Properties		
Soil pH 1:2 (H_20)	6.20	5.90
Organic carbon(gkg^{-1})	4.6	4. 8
Available P($mgkg^{-1}$)	6.48	6.88
Total N (gkg^{-1})	0.56	0.67
CEC[C mol(+)kg^{-1}]	3 .20	3 .44
***Exchangeable bases* [C mol(+) kg^{-1}]**		
Ca^{++}	1 .88	1 .92
Mg^{++}	0.42	0.40
K^+	0.47	0.53
Na^+	6.20	0.34

Source: Field work, 2011.

Table 2. Composition of Boost-Extra foliar fertilizer according to label.

Element	Symbol	Quantity (%)
Nitrogen	(N)	20%
Phosphate	(P)	20%
Potassium	(K)	20%
Magnesium	(Mgo)	1.5%
Iron EDTA	(Fe)	0.15%
Manganese EDTA	(Mn)	0.075%
Copper EDTA	(Cu)	0.075%
Zinc EDTA	(Zn)	0.075%
Boron	(B)	0.0315%
Cobalt EDTA	(Co)	0.0012%
Molybdenum	(Mo)	0.0012%

Source: Field work, 2011.

which were combinations of soil applied granular NPK fertilizer and Boost Extra foliar fertilizer (NPK 0:0:0 - Boost Extra OLha^{-1}; NPK 120:60:60 + Boost Extra 6 Lha^{-1}; NPK 90:45:45 + Boost Extra 6 Lha^{-1}; NPK 60:30:30 + Boost Extra 6 Lha^{-1}; NPK 30:15:15 + Boost Extra 6 Lha^{-1}; NPK 0:0:0 + Boost Extra 6 Lha^{-1}; NPK 120:60:60 + Boost Extra 0Lha^{-1}) replicated 3 times.

Description of Maize Varieties used (Oba 98 hybrid and TZESR-W)

Although, maize gram provides macro- and micro-nutrients required for human diet but it lacks adequate amounts of essential amino acids; lysine and tryptophan. Therefore, a superior maize cultivar named quality protein maize (QPM) was discovered to improve maize nutrition compared to the traditional maize types (Emily and Sherry, 2012). Oba 98 hybrid is quality protein maize, which was introduced by IITA (2006) and this is one of the varieties used. TZESR-W is also an improved maize variety which is an open pollinated commonly grown by the famers.

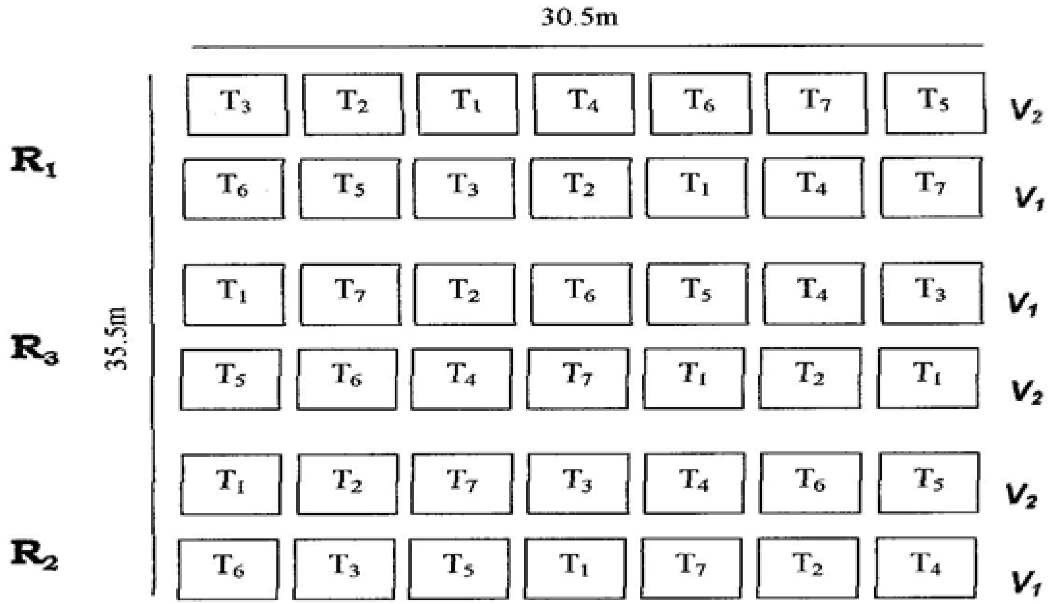

Figure 1. R_1, R_2, R_3; V_1, V_2,= Represent Replication 1, 2, 3, and Variety 1 and2, respectively.

Plot Size

Gross and net plots were 5.00m x 4.5m (22.5 m^2) 6 rows and 5.00m x 3.00m (15m^2) 4 inner rows respectively (See Figure 1).

Experimental Layout

T_1: (Control) = 0: 0: 0 NPK + 0 Lha^{-1} Boost-Extra
T_2: = 120: 60: 60 NPK + 6 Lha^{-1} Boost-Extra
T_3: = 90: 45: 45 NPK + 6 Lha^{-1} Boost-Extra
T_4: = 60: 30: 30 NPK + 6 Lha^{-1} Boost-Extra
T_5: = 30: 15: 15 NPK + 6 Lha^{-1} Boost-Extra
T_6:= 0: 0: 0: NPK + 6 Lha^{-1} Boost-Extra
T_7:= 120: 60: 60 NPK + 0 Lha^{-1} Boost-Extra

Seed Dressing

The seeds were treated with one sachet of Apron-plus 60D (l0g per kg of seeds) against fungal or insect attack.

Sowing and Spacing

Seed Sowing was carried out in the first year on 5th July, 2011, while in the second year seeds were sown in July, 2012. After harrowing, two seeds at a spacing of 75cm x 25cm were sown and subsequently, thinned to one plant per stand at two (2) Weeks After Sowing (WAS).

Weed Control

Atrazine was applied as pre-emergence herbicide at 3kg/ha immediately after sowing and was followed by two hoe-weeding at 4 and 8 weeks after sowing.

Fertilizer Application

Compound fertilizer (NPK: 15: 15:15) grade was applied at 2 WAS according to the rate for each treatment. The remaining half dose of N was applied at 6 WAS in the form of urea. Boost – Extra foliar fertilizer was applied in the evening time at the rate of 3 Lha^{-1}at 2 and 6 WAS using a Knapsack sprayer.

Data Collection

The following data were collected:

Plants

The number of plants per net plot was counted and

recorded at 3 WAS and at harvest.

Crop Vigour Score

Crop vigour was assessed visually at 3, 6, 9 and 12 WAS using the scale of 1 to 5 (1 = very poor vigour; 2 = poor vigour; 3 moderately vigorous; 4 = vigorous; 5 = very vigorous). The assessing features of vigour score used included plant height, number of leaves, greenness of leaves, leaf size and stem girth.

Plant Height (cm)

With the use of measuring tape, the height of five tagged plants, selected randomly in each net plot were measured from the ground level to the innermost leaf base at 3, 6, 9 and 12 WAS and their mean determined.

Stem Girth (cm)

Stem girth at 5cm above ground was measured from 5 randomly selected plants in each net plot at 3, 6, 9 and 12 WAS. This was done using venire callipers and their mean values were recorded.

Number of Leaves per Plant

Number of leaves for each of the randomly selected plant samples in each net plot was counted at 3, 6, 9 and 12 WAS and their mean determined.

Leaf Area (LA)

Leaf area was determined at 3, 6, 9 and 12 WAS. At each stage, two plants were uprooted from each gross plot and leaf area determined by measuring the length multiplied by the width at the broadest point of the leaf and then multiplied by a factor (0.75). The factor was obtained as the ratio of estimated area of the leaf outline on a graph sheet to the product of its length and breadth at the widest portions (Pal and Murari, 1985). The summation gave leaf area for the two plants.

Leaf Area Index (LAI)

LAI was determined at 3, 6, 9 and 12 WAS. This was calculated by dividing the total leaf area (LA) of two plant samples collected from each plot by the ground area cover of the two plant stands. Thus, LAI was determined as follows:

$$\frac{LAI = LA}{\text{Total GA}}$$

Where LA = total leaf area of two plants and GA total ground area of the two plants.
(Pal and Murari, 1985)

***Shoot Dry Matter (g)*:**

Shoot dry matter was determined at 3, 6, 9 and 12 WAS. This was done by oven-drying the selected plant samples at 70^0C for 48 hours and the dry weight determined with the aid of electrical weighing balance.

***Crop Injury*:**

Crop injury/leaf burn was assessed visually at 3, 6, 9 and 12 WAS using the scales 1-5 to represent no injury to very severely injured plants.

***Crop Growth Rate (CGR)*:** The CGR was computed from the plant dry-weight of each plot at 3, 6, 9 and 12 WAS using the formula:

$$CGR = \frac{(W_2 - W_1)}{T_2\ T_1}$$

Where: W_2 - W_1 - Dry matter variation at different stage in grams, while T_1 - T_2 - Time variations in days (Alabadi et al., 2008).

RESULTS AND DISCUSSIONS

Plant Height at 3, 6, 9 and 12 WAS

At all the growth stages in the two years of the investigation, Oba 98 produced plants that were significantly taller than that of TZESR-W except at 12 WAS. It has been observed that improved crop varieties exhibit superior growth performance (Azeez et al., 2003). Also, fertilization remarkably affected plant height at all growth stages in both years and combined analysis. At 3 WAS in the study, application of NPK 120:60:60 + 6Lha^{-1} Boost – Extra, NPK 90:45:45 + 6Lha^{-1} Boost Extra and sole NPK 120:60:60 exhibited plants of comparable heights that were appreciably taller than all other treatments except NPK 60:30:30 + 6Lha^{-1} Boost

Table 3. Effect of variety and fertilizer on plant height of maize at 3 and 6 WAS grown at Mubi in 2011 and 2012 rainy seasons.

	Height (cm)					
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
0ba98	20.55a	20.50a	20.53a	80.53a	81.49a	81.01a
TZESR-W	18.62b	18.81b	18.72b	79.15b	79.16b	79.16b
S.Em. ±	0.144	0.035	0.074	0.280	0.225	0.024
Level of significance	*	*	*	*	*	*
Fertilizer						
NPK + (kgha^{-1})						
0:0:0 +	17.46e	18.08c	17.77e	52.96d	53.50d	53.23d
120:60:60 +	20.65a	20.53a	20.59a	95.91a	96.80a	96.35a
90:45:45 +	20.50a	20.51a	20.50a	95.06a	95.80a	95.43a
60:30:30 +	20.15b	20.OOab	20.07b	90.96b	90.33b	90.65b
30:15:15 +	19.71c	19.73b	19.72c	75.08c	75.51c	75.30c
0:0:0 +	18.33d	18.25c	18.29d	53.03d	53.61d	53.32d
120:60:60 +	20.4lab	20.SOa	20.45a	95.88a	96.73a	96.30a
S.Em.±	0,068	0.160	0.130	0.676	0.445	0.405
Level of significance	*	*	*	*	*	*
***Interaction* Variety x Fertilizer**	ns	ns	ns	Ns	ns	Ns

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
*=Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

Extra in 2012, which also produced plants of similar height. Boost Extra (6Lha^{-1}) treatment alone produced markedly shorter plants that were only superior to zero fertilized plants in 2011 and the combined data at 3 WAS, while these two treatments were at par in 2012 and they recorded the least plant heights compared to all other treatments. There was no significant interaction between variety and fertilizer at this stage.

Response in plant height at 6, 9 and 12 WAS were found to vary significantly across fertilizer rates throughout the years (Table 3 and 4). The results of the analysis revealed that treatments NPK 120:60:60 + Boost Extra 6 Lha^{-1}, NPK 90:45:45 + Boost – Extra 6 Lha^{-1} and NPK 120:60:60 without Boost Extra were statistically similar and recorded the tallest plants. This was followed by the plant heights from NPK 60:30:30 + Boost Extra 6 Lha^{-1} that excelled NPK 30:15 :15 + Boost Extra 6 Lha^{-1}, whereas sole Boost Extra (6 Lha^{-1}) treatment and the zero fertilizer treatment were similar and produced the shortest plants throughout the years. Foliar fertilizer containing NPK can only be used as supplement to soil applied fertilizer (Ling and Silberush, 2007).

There was significant interaction between variety and fertilizer treatments in plant height at 6 WAS from combined season analysis and at 9 WAS in the

Table 4. Effect of variety and fertilizer on plant height of maize at 9 and 12 WAS grown at Mubi in 2011 and 2012 rainy seasons.

	Height (cm)					
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
0ba 98	132.20a	135.89a	134.04a	156.22	155.94	156.08a
TZESR.W	129.78b	130.02b	129.90b	151.39	151.28	151.34b
S.Em. ±	0.211	0,120	0.159	0.519	0.810	0.200
Level of significance	*	*	*	Ns	ns	*
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	114.50d	116.73d	115.61d	133.68d	133.96d	133.82d
120:60:60 + 6	140.18a	142.63a	141.40a	165.80a	165.86a	165.83a
90:45:45 + 6	139.91a	142.36a	141.14a	165.26a	165.28a	165.27a
60:30:30 + 6	137.05b	138,11b	137.58b	161.38b	161.10b	161.42b
30:15:15 + 6	130.93c	131.05c	130.99c	150.88c	150.0lc	150.45c
0:0:0 + 6	114.63d	116.85d	1l5.74d	133.65d	133.35d	133.50d
120:60:60 + 0	140.15a	142.55a	141.35a	165.66a	165.75a	165.70a
S.Em. ±	0.555	0.582	0.402	1.127	0.726	0.704
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	*	*	*	ns	ns	ns

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
Ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

two years and the combined data.

Plant Stem Girth at 3, 6, 9 and 12 WAS

There was no significant difference between the stem girth of Oba 98 and TZESR-W maize at 3 WAS in both cropping seasons. At 6, 9 and 12 WAS, the stem girth of Oba 98 differed significantly from TZESR-W maize except at 9 WAS in 2012. The stem girth varied across fertilizer treatments (Table 6 and 7). At 3 WAS in 2011 and the combined data, treatments NPK 120:60:60 + Boost – Extra 6 Lha^{-1}, NPK 90:45:45 + Boost – Extra 6 Lha^{-1}, NPK 60:30:30 + 6 Lha^{-1} Boost – Extra and sole NPK 120:60:60 were statistically similar and produced plants of thicker stem girth than treatment NPK 30:15:15 + 6 Lha^{-1} Boost – Extra. Plants treated with only Boost – Extra and the non-fertilized treatment exhibited plants with comparable and thinnest stem girth.

At 6 WAS; treatments NPK 120:60:60 + 6 Lha-^{1} Boost – Extra, NPK 90:45:45 + Boost – Extra 6 Lha^{-1} and NPK 120:60:60 without Boost – Extra produced plants with similar and thickest stem girth in the two years and the combined data. This was followed by stem girth obtained from treatments NPK 60:30:30 +

Table 5. Effect of variety and fertilizer on stem girth of maize at 3 and 6 WAS grown at Mubi in 2011 and 20l2 rainy seasons.

Stem girth (cm)						
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	0.92	0.92	0.92	2.20a	2.20a	2.20a
TZESR-W	0.91	0.91	0.91	2.09b	2.09b	2.09b
S.Em. $\pm$	0.02	0.03	0.02	0.004	0.005	0.003
Level of Significance	Ns	Ns	ns	*	*	*
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	0.90c	0.91c	0.91c	1.91d	1.91d	1.91d
120:60:60 + 6	0.92a	0.92a	0.92a	2.28a	2.28a	2.28a
90:45:45 + 6	0.92a	0.92a	0.92a	2.27a	2.28a	2.27a
60:30:30 + 6	0.92a	0.92a	0.92a	2.23b	2.23b	2.23b
30:15:15 + 6	0.91b	0.9lbc	0.91b	2.lOc	2.lOc	2.lOc
0:0:0 + 6	0.90e	0.91c	0.91c	1.91d	l.91d	1.91d
120:60:60 + 0	0.92a	0.92a	0.92a	2.28a	2.28a	2.28a
S.Em. $\pm$	0.002	0.002	0.016	0.007	0.006	0.005
Level Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	ns	Ns	ns	ns	ns	ns

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

6 Lha^{-1} Boost – Extra and then NPK 30:15:15 +Boost – Extra 6 Lha^{-1}.

The stem girth of plants fertilized with Boost – Extra 6 Lha^{-1} foliar fertilizer and the zero fertilizer treatment were at par and recorded the least stem girth throughout the experimental period. The stem girth was also influenced by NPK rates at 9 and 12 WAS. At these growth stages, the effects of treatments NPK 120:60:60 + Boost – Extra 6 Lha^{-1}, NPK 90:45:45 + Boost – Extra 6 Lha^{-1} and sole NPK 120:60:60 were statistically comparable and produced plants with markedly thicker stem girth than the other treatments. However, at 9 WAS in 2012, NPK 120:60:60 + Boost Extra, gave plants of comparable stem girth with NPK 90:45:45 + 6 Lha^{-1} Boost Extra. NPK 60:30:30 + 6 Lha^{-1} Boost Extra exhibited plants with considerably thicker stem than NPK 30:15:15 + 6 Lha^{-1} Boost Extra, while sole Boost Extra 6 Lha^{-1} and unfertilized treatments recorded plants with comparable and the thinnest stem girth.

There was no significant interaction between variety and fertilizer on stem girth at 3 and 6 WAS. Whereas at 9 and 12 WAS, the interaction was significant except at 9 WAS in 2012.

Crop Vigour Score at 3, 6, 9 and 12 WAS

There was no significant difference in crop vigour between Oba 98 and TZESRW varieties at 3, 6, 9, and 12 WAS (Table 8 and 9).

At 3 WAS, treatments NPK 120:60:60 + Boost Extra 6 Lha^{-1}&, NPK 90:45:45 + Boost – Extra 6 Lha^{-1}, NPK 60:30:30 + Boost Extra 6 Lha^{-1} and sole NPK 120:60:60 produced plants of comparable vigour that were remarkably more vigorous than treatments NPK 30:15:15 + Boost Extra 6 Lha^{-1}, followed by sole Boost Extra 6 Lha^{-1} and then the

Table 6. Effect of variety and fertilizer on stem girth of maize at 9 and 12 WAS grown at Mubi in 2011 and 2012 rainy seasons.

Steam girth (cm)						
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	2.44a	2.36	2.40a	2.76a	2.78a	2.77a
TZESR-W	2.28b	2.28	2.28b	2.63b	2.64b	2.63b
S.Em. $\pm$	0.008	0.059	0.029	0.011	0.015	0.013
Level of Significance	*	Ns	*	*	*	*
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	2.05d	2.03d	2.04d	2.22d	2.24d	2.23d
120:60:60 + 6	2.59a	2.54a	2.57a	3.02a	3.Ola	3.Ola
90:45:45 + 6	2.57a	2.52ab	2.54a	2.96a	2.97a	2.98a
60:30:30 + 6	2.50b	2.45b	2.48b	2.86b	2.86b	2.86b
30:15:15 + 6	2.17c	2.16c	2.16c	2.60c	2.62c	2.60c
0:0:0 + 6	2.05d	2.03d	2.04d	2.23d	2.23d	2.23d
120:60:60 + 0	2.62a	2.56a	2.59a	3.02a	3.02a	3.02a
S.Em. $\pm$	0.030	0.029	0.017	0.018	0.018	0.013
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	*	ns	*	*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

control treatment, respectively. However, the effect of treatment NPK 60:30:30 + Boost Extra 6 Lha^{-1} was still comparable to treatment NPK 30: 15: 15 + Boost Extra 6 Lha^{-1} on crop vigour at 3 WAS in 2012 data and as well as in the combined data. Effect of Boost Extra foliar fertilizer 6 Lha^{-1}&1 on crop vigour was significant against the unfertilized plants only at 3 Weeks after sowing

At 6, 9 and 12 WAS, treatments NPK 120:60:60 + Boost Extra 6 Lha-^{1}, NPK 90:45:45 + Boost Extra 6 Lha^{-1} and sole NPK 120:60:60 were statistically similar and exhibited the most vigorous plants, which was followed by treatment. NPK 60:30:30 + Boost Extra 6 Lha^{-1} and then NPK 30:15:15 + 6 Lha^{-1} + Boost Extra. However, at 12 WAS in 2011 and 2012 analyses, NPK 30:15:15 + 6 Lha^{-1} Boost Extra showed comparable crop vigour to NPK 60:30:30 + 6 Lha^{-1} Boost Extra.

The results showed no appreciable difference between crop vigour in Boost Extra 6Lha^{-1} and unfertilized plants. They both produced plants with the poorest vigour in contrast to plants that received soil applied NPK.

Interaction between variety and fertilizer effects on crop vigour was only significant at 6 WAS in the two years and the combined analysis.

Dry Matter at 3, 6, 9 and 12 WAS

There was no remarkable difference between shoot dry matter of Oba 98 and TZESR-W at 3 WAS, but significant variation was noticed between these

Table 8. Effect of variety and fertilizer on vigour score of maize plant at 3 and 6 WAS grown at Mubi, in 2011 and 2012 rainy seasons.

Crop vigour (cm)						
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	3.92	3.95	3.94	3.38	3.39	3.39
TZESR-W	3.91	3.93	3.92	3.35	3.34	3.35
S.Em. ±	0.024	0.051	0.037	0.020	0.020	0.015
Levelof Significance	ns	ns	ns	ns	Ns	ns
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	3.33d	3.32d	3.33d	2.26d	2.27d	2.27d
120:60:60 + 6	4.20a	4.27a	4.24a	4.00a	4.00a	4.00a
90:45:45 + 6	4.13a	4.20a	4.16a	4.00a	4.00a	4.00a
60:30:30 + 6	4.10a	4.11ab	4.10ab	3.76b	3.76b	3.76b
30:15:15 + 6	3.92b	3.93b	3.93b	3.20c	3.20c	3.20c
0:0:0 + 6	3.60c	3.59c	3.60c	2.33d	2.35d	2.34d
120:60:60 + 0	4.13a	4.16a	4.15a	4.00a	4.00a	4.00a
S.Em. ±	0.045	0.058	0.054	0.036	0.027	0.025
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	ns	ns	ns	*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

varieties on shoot dry matter at 6, 9 and 12 WAS. The shoot dry matter was significantly affected by NPK levels at all growth stages of maize except at 3 WAS (Table 11 and 12).

At 6 WAS in 2011, analysis showed NPK 120:60:60 + Boost Extra 6Lha^{-1}, NPK 90:45:45 + Boost Extra 6Lha^{-1} and sole NPK 120:60:60 produced shoot dry matter that were at par and appreciably heavier than that of NPK 60:30:30 + Boost Extra 6Lha-^{1}, which was followed by treatment NPK 30:15:15 + Boost Extra 6Lha^{-1}.

Boost Extra (6Lha^{-1}) treated plants produced comparable shoot dry matter as in the unfertilized plants and both recorded the least shoot dry matter among all other treatments. At 9 and 12 WAS, treatments with NPK 120:60:60 + Boost Extra 6 Lha^{-1}, NPK 90:45:45 + 6 Lha-^{1} Boost Extra and sole NPK 120:60:60 still recorded the highest shoot dry matter. But the combined data revealed that, NPK 120:60:60 + Boost Extra 6 Lha^{-1} and NPK 120:60:60 alone were similar and significantly yielded higher shoot dry weight than NPK 90:45:45 + Boost Extra 6 Lha^{-1}, followed by NPK 60:30:30 + Boost Extra 6 Lha^{-1} and treatment NPK 30:15:15 + Boost Extra 6 Lha-^{1}, respectively. Thus, shoot dry weight decreased considerably with decreasing granular fertilizer dose, because Boost Extra (6 Lha^{-1}) and zero fertilized plants exhibited the least shoot dry matter that were statistically at par. According to Yuncai et al (2008), the primary nutrients for maize growth and yield are provided by NPK fertilizers. Application of NPK 120:60:60 $kgha^{-1}$ proved significant in increasing shoot dry matter weight (El-Fattah, 2012).

Significant interaction effect on shoot dry weight was only observed in 2012 at 9 WAS.

Table 9. Effect of variety and fertilizer on vigour score of maize plant at 9 and 12 WAS grown at Mubi in 2011 and 2012 rainy seasons.

Crop vigour (cm)						
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	3.32	3.32	3.32a	3.19	3,19	3.19
TZESR-W	3.26	3.26	3.26b	3.14	3.14	3.14
S.Em. +	0.012	0.012	0.007	0.034	0.034	0.026
Level of Significance	ns	ns	*	ns	Ns	ns
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	2.16d	2,16d	2.16d	2.00c	2.00c	2.00d
120:60:60 + 6	3.97a	3.95a	3.96a	4.00a	4.00a	4.00a
90:45:45 + 6	3.96a	3.96a	3.96a	4.00a	4.00a	4.00a
60:30:30 + 6	3.71b	3.74b	3.73b	3.16b	3.16b	3.16b
30:15:15 + 6	3.03c	3.03c	3.03c	3.00b	3.00b	3.00c
0:0:0 + 6	2.24d	2.23d	2.23d	2.00c	2.00c	2.00d
120:60:60 + 0	3.96a	3.96a	3.96a	4.00a	4.00a	4.00a
S.Em. +	0.040	0,040	0.028	0.063	0.063	0.045
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	*	ns	*	*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

Leaf Area Index (LAI) of Maize Grown in 2011 and 2012 in Mubi

There was no significant difference in the LAI between Oba 98 and TZESR-W and also among the fertility treatments at 3 WAS (Table 13). At 6, 9 and 12 WAS, Oba 98 produced significant LAI than TZESR-W in both years. The LAI was found to respond positively with increased rate of NPK fertilizer. NPK 120:60:60 + 6 Lha^{-1} Boost – Extra NPK 90:45:45 + 6 Lha^{-1} Boost – Extra and sole NPK 120:60:60 were statistically comparable and recorded the highest LAI at 6 WAS.

At 9 and 12 WAS, the LAI was positively influenced by NPK rates. Application of NPK 120:60:60 + 6 Lha^{-1} Boost – Extra and NPK 120:60:60 alone had a similar effect and remarkable produced higher LAI than NPK 90:45:45 + 6 $Laha^{-1}$ Boost – Extra which were followed by NPK 60:30:30 + 6 Lha^{-1} Boost – Extra and NPK 30:15:15 + 6 Lha^{-1} Boost – Extra, respectively. However, NPK 90:45:45 + 6 Lha^{-1} Boost – Extra showed comparable LAI to the superior treatments (NPK 120:60:60 + 6 Lha^{-1} Boost – Extra and NPK 120:60:60 alone) in 2011 cropping season. The unfertilized plants and sole Boost – Extra treated plants were similar and recorded the least LAI throughout the growth stages in both the years. Thise foregoing is found to be in-line with the findings of Mahmoodi et al (2011), that nitrogen lead to high leaf index and consequently increased leaf duration and photosynthates concentration.

There was significant effect of interaction between variety and fertilizer treatments on LAI at 6, 9 and 12

Table 11. Effect of variety and fertilizer on dry matter (DM) of maize plant at 3 and 6 WAS grown at Mubi in 201l and 2012 rainy seasons.

Dry matter in gram (g.plant^{-1})						
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	1.19	1.20	1.20	30.25	31.63a	30.94a
TZESR-W	0.97	1.11	1.04	29.91	29.91b	29.91b
S.Em. ±	0.296	0,310	0.236	0.258	0,249	0.21
Level of Significance	Ns	ns	ns	ns	*	*
Fertilizer						
NPK + Boost-Extra						
(kgha^{-1}) (Lha^{-1})						
0:0:0 + 0	0.96	1.06	1.01	12.81d	13.60d	13.20d
120:60:60 + 6	1.10	1.11	1.10	42.71a	43.81a	43.26a
90:45:45 + 6	1.04	1.10	1,07	41.87a	43.18a	42.52a
60:30:30 + 6	0.98	1,09	1.03	37.17b	37.36b	37.2Th
30:15:15 + 6	1.50	1.60	1.55	21.00c	21.9c	21.0Sc
0:0:0 + 6	0.96	1.04	1.00	12.29d	13.58d	12.94d
120:60:60 + 0	1.08	1,10	1.09	42.72a	44.04a	43.38a
S.Em. ±	0.575	0.575	0.407	0.587	0.572	0.41
Level of Significance	Ns	ns	ns	*	*	*
Interaction Variety x Fertilizer	Ns	ns	ns	ns	ns	ns

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

Table 12. Effect of variety and fertilizer on dry matter of maize plant at 9 and 12 WAS in 2011 and 2012.

Dry matter in gram (gplant^{-1})						
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	111.63a	110.14a	110.88a	180.46a	180.47a	180.46a
TZESR-W	104.53b	106.02b	105.28b	155.38b	155.35b	155.37b
S.Em. ±	0.202	0.177	0,11	0.264	0.586	0.083
Level of Significance	*	*	*	*	*	*
Fertilizer						
NPK + Boost-Extra						
(kgha^{-1}) (Lha^{-1})						
0:0:0 + 0	59.97d	60.00d	59.98e	116.20d	116.22d	116.21e
120:60:60 + 6	139.82a	139.80a	139.81a	202.09a	202.08a	202,08a
90:45:45 + 6	139.66a	138.65a	138.66ab	200.61a	199.98a	200.30b

Table 12. Contd.

60:30:30 + 6	**125.94b**	**125.95b**	**125.95c**	**185.81b**	**186.13b**	**185.97c**
30:15:15 + 6	92.30c	92.28c	92.29d	151.66c	151.74c	151.70d
0:0:0 + 6	60.12d	60,13d	60.12e	117.04	117.23d	117.13e
120:60:60 + 0	139.76a	138.79a	139.27a	202.01	201.99a	202.00a
S.Em. +	0.481	0.494	0.339	0.635	0.638	0.449
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	ns	*	*	ns	ns	ns

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

Table 13. Effect of variety and fertilizer on leaf area index (LAI) of maize plant at 9 and 12 WAS in 2011 and 2012.

Leaf Area Index						
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	0.17	0.17	0.17	1.70a	1.70a	1.70a
TZESR-W	0.17	0.17	0.17	1.57b	1.57b	1.57b
S.Em. +	0.009	0.004	0.005	0.004	0.005	0.003
Level of Significance	Ns	ns	Ns	*	*	*
Fertilizer						
NPK + Boost-Extra						
(kgha^{-1}) (Lha^{-1})						
0:0:0 + 0	0.16	0.16	0.16	1,09d	1.09d	1.09d
120:60:60 + 6	0.17	0.17	0.17	1.95a	1.95a	1.95a
90:45:45 + 6	0.17	0.17	0.17	1.94a	1.94a	1.94a
60:30:30 + 6	0.17	0.17	0.17	1.87b	1.87b	1.87b
30:15:15 + 6	0.17	0.17	0.17	l.55c	1.55c	l.55c
0:0:0 + 6	0.16	0.17	0.17	1.ld	1.lod	1.10d
120:60:60 + 0	0.17	0.17	0.17	l.94a	1.94a	1.94a
S.Em. +	0.03	0.02	0.020	0.012	0.012	0.008
Level of Significance	ns	ns	Ns	*	*	*
Interaction Variety x Fertilizer	ns	ns	Ns	ns	ns	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT).
* = Statistically significant difference at 5% level of probability.
ns = Not significantly different at 5% level of probability.
Source: Computed from field data (2011/2012).

Table 14. Effect of variety and fertilizer on leaf area index (LAI) of maize plant at 9, 12 WAS in 2011 and 2012.

Leaf Area Index						
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	2.53a	2.54a	2,53a	2.83a	2.81a	2.82a
TZESR-W	2.10b	2.08b	2.09b	2.28b	2.31b	2.30b
S.Em. ±	0.007	0.008	0.005	0.012	0.014	0,008
Level of Significance	*	*	*	*	*	*
Fertilizer						
NPK + Boost-Extra						
(kgha^{-1}) (Lha^{-1})						
0:0:0 + 0	1.97d	1.96e	1.96e	2.11e	2.11e	2.11e
120:60:60 + 6	2,49a	2.50a	2.49a	2.84a	2.84a	2.84a
90:45:45 + 6	2.48a	2.48b	2.48b	2,78b	2,80b	2.79b
60:30:30 + 6	2.43b	2.42c	2.42c	2,70c	2.71c	2.71c
30:15:15 + 6	2.32c	2.31d	2.31d	2.52d	2.51d	2.51d
0:0:0 + 6	1.95d	1.98e	1.97e	2.12e	2.12e	2.12e
120:60:60 + 0	2.52a	2.52a	2.52a	2.84a	2.84a	2.84a
S.Em. ±	0.015	0,014	0.010	0.014	0.014	0.009
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	*	*	*	*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05
* Statistically significant difference at 5% level of probability
ns = Not significantly different at 5% level of probability
WAS = Weeks after sowing

Table 15. Effect of variety and fertilizer on crop growth rate (CGR) of maize plant at 3, 6 WAS grown at Mubi, in 2011 and 2012 rainy seasons.

Crop Growth Rate						
	3 WAS			6 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	O.06	2.54a	0.06	1.52a	1.51a	1.51a
TZESR-W	0.06	2.08b	0.()7	I.43b	1.44b	1.44b
S.Em. ±	O.004	0.008	0.001	0.004	0.003	0.0026
Level of Significance	Ns	Ns	ns	*	*	*
Fertilizer						
NPK + Boost-Extra						
(kgha^{-1}) (Lha^{-1})						
0:0:0 + 0	0.06	0.06	0.06	0.78d	0.76d	0.77d
120:60:60 + 6	0.06	0.06	0.07	2.05a	2.04a	2.()5a
90:45:45 + 6	0.06	0.06	0.07	2.03a	2.02a	2.02a
60:30:30 + 6	0.06	0,06	0.06	1.72h	1.72h	1.72h

Table 14. Contd.

30:15:15 + 6	**0.06**	**006**	**0.06**	**0.63c**	**0.91c**	**0.93c**
0:0:0 + 6	0.06	0.06	0,06	0.770	0.780	0.780
120:60:60 + 0	0.06	0.06	0.07	2,04a	2.05a	2.05n
S.Em. <u>+</u>	0.00	0.002	0.003	0.020	0.020	0.014
Level of Significance	Ns	ns	ns	*	*	*
***Interaction* Variety x Fertilizer**	*	*	*	*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT)
* Statistically significant difference at 5% level of probability
ns = Not significantly different at 5% level of probability
WAS= Weeks after sowing

WAS in both years.

Crop Growth Rate (CGR) on Maize Grown Mubi in 2011 and 2012 Cropping Seasons

The CGR of Oba 98 was ignificant1y different from TZESR-W at 6, 9 and 12 WAS (Table l5 and 16). The CGR was found to increase with NPK fertilizer application rates at 6, 9 and 12 WAS. At these growth stages, NPK 120:60:60 + 6 Lha^{-1} Boost – Extra, NPK 90:45:45 + 6 Lha^{-1} Boost – Extra and sole NPK 20:60:60 were statistically at par and exhibited the highest CGR, this was followed by NPK 60:30:30 + 6 Lha^{-1} Boost – Extra and then NPK 30:15:15, respectively. Boost – Extra (6 Lha^{-1}) and zero fertilizer treatments showed statistically comparable effects and exhibited the least CGR in the two years. However, at 12 WAS the results of the analysis revealed no difference between CGR recorded from NPK 60:30:30 + 6 Lha^{-1} Boost – Extra and NPK 30:15:15 + 6 Lha^{-1} Boost – Extra in both years, also no appreciable difference between the CGR obtained from sole Boost – Extra and unfertilized plants throughout the growing stages which had the least CGR.

Significant interaction between variety and fertilizer on CGR was noticed with combined data at 9 WAS and at 12 WAS in 2012 and the combined data.

Days to 50% Tasselling

In the two years and the combined analysis, Oba 98 tasselled earlier than SZESR-W (Table 17). The sole Boost Extra 6Lha^{-1} and non-fertilized treatment recorded comparable time of tasselling but tasselled earlier than the other treatments in combination with granular NPK in 2011 and 2012.

The combined season analysis however, pointed that application of NPK 30:15:15 + Boost Extra 6Lha^{-1} showed rewarded effect on tasselling earlier than NPK 120:60:60 + Boost Extra 6Lha^{-1}, NPK 90:45:45 + Boost Extra 6Lha^{-1}, 4PK 60:30:30 + Boost Extra 6Lha^{-1} and sole NPK 120:60:60, which had comparable time of tasselling, but delayed tasselling beyond that of non-ferti1ized and sole Boost Extra treatments. There was significant interaction between variety and fertilizer with respect to time of tasselling.

CONCLUSION

The investigation has shown that Oba 98 out-performed TZESR-W and showed significantly higher performance in vegetative characters. Application of NPK 120:60:60 alone and NPK 120:60:60 + 6 Lha^{-1} Boost Extra had similar effects on vegetative growth. The use of sole Boost Extra foliar fertilizer at 6 Lha^{-1} appeared to have effect only on plant height and vigour at 3 WAS. In view of the above therefore, application of Boost Extra (6 Lha^{-1}) foliar fertilizer either alone or in combination with soil applied NPK has not shown significant effect on growth performance of maize crop. Thus, the best method to apply fertilizer to maize plant in Mubi South Local Government is through soil applied NPK fertilizer, because economic benefit of foliar fertilization on maize does not seem feasible. On the other hand, Oba 98 appears to be a

Table 16. Effect of variety and fertilizer on crop growth rate (CGR) of maize plant at 9, 12 WAS grown at Mubi in 2011 and 2012 rainy seasons.

Crop Growth Rate (CGR)						
	9 WAS			12 WAS		
Treatment	2011	2012	Combined	2011	2012	Combined
Variety						
Oba 98	3.77a	3.78a	3,78a	3.33a	3.32a	3.32
TZESR-W	3.58b	3.57b	3.57b	2.37b	2.36b	2,36
S.Em. +	0.006	0.007	0.005	0.008	0.016	0.013
Level of Significance	*	*	*	*	*	*
Fertilizer						
NPK + Boost-Extra						
($kgha^{-1}$) (Lha^{-1})						
0:0:0 + 0	2.27d	2.27d	2.27d	2.68c	2.67c	2.68c
120:60:60 + 6	4.53a	4.54a	4.53a	2.97a	2.96a	2.94a
90:45:45 + 6	4.55a	4.53a	4.54a	2.97a	2.93a	2.95a
60:30:30 + 6	4.20b	4.18t	4.20b	2.86b	2. 85h	2.85h
30:15:15 + 6	3.38c	3.39c	3.39c	2.82h	2.83h	2 82h
0:0:0 + 6	2.28d	2.27d	2.27d	2,71c	2.68c	2.69e
120:60:60 + 0	4.53a	4.51a	4.52a	2.97a	2.96a	2.96a
S.Em. +	0.026	0.026	0.018	0.024	0.022	0.016
Level of Significance	*	*	*	*	*	*
Interaction Variety x Fertilizer	ns	ns	*	ns	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT)
* Statistically significant difference at 5% level of probability
ns = Not significantly different at 5% level of probability
Source: Computed from field data (2011/2012)

Table 17. Effect of variety and fertilizer on days to 50% tassel of maize grown at Mubi in 2011 and 2012 rainy seasons.

Treatment		2011	2012	Combination
Variety Oba 98		55.48a	55.43a	55.45a
TZESR-W		58.71b	58.71b	58.71b
S.Em. +		0.178	0.154	0.118
Level of significant		*	*	*
Fertilizer NPK + ($kgha^{-1}$) +	Boost-Extra (Lha^{-1})			
0:0:0 +	0	55.50a	55.50a	55.50a
20:6O:60 +	6	57.66b	57.50b	57.58bc
0:45:45 +	6	57.66b	57.50b	57.58bc
60:30:30 +	6	57.83 b	57.66b	57.75bc
30:15:15 +	6	57.33b	57.33b	57.33b

Table 17. Contd.

0:0:0 +	**6**	**55.83a**	**56.00a**	**55.91a**
20:60:60 +	6	57.83b	58.00b	57.92c
S.Em. +	0	0.215	0.215	0.152
Level of Significance		*	*	*
Interaction Variety x Fertilizer		*	*	*

Mean values with the same letter in each treatment group are not significantly different at P = 0.05 (DMRT)
* = Statistically significant difference at 5% level of probability
ns = Not significantly different at 5% level of probability
Source: Computed from field data (2011/2012)

promising maize variety in Mubi South Local Government Area of Adamawa State, Nigeria.

RECOMMENDATION

Based on the findings of this study, NPK 120:60:60 + Boost Extra 6 Lha^{-1}, NPK 90:45:45 + Boost Extra 6Lha^{-1} and sole NPK 120:60:60 is recommended in Northern Guinea Savannah. it is also recommended that further study be conducted to determine the effects of various types of foliar fertilizers in combination with soil applied NPK on maize growth performance, to ascertain the effects of foliar fertilizer on drought and flooding stress on maize plants grown in Northern Guinea Savannah and to find out the critical growth stages at which foliar fertilizer application could give economic benefit in maize production.

REFERENCES

Ado SG, Adamu RS, Hussaini MA, Maigida DN and Zaraafi AB (2004). Cereals in Nigeria. Principles of production and Utility. (Ed) N.U.A. Iden and F.A. Showemimo. Inst. For Agric. Res., ABU Zaria, Nigeria. Pp 86-91.

Alabadi FH, Lebaschi MH, Shiranirad AH, Valadabadi SAR, Hamid A and Daneshian J (2008). Effects of Arbuscular Mycorrhizal Fungi (Glomushi), different levels of phosphorus and drought stress on physiological growth indices of coriander (*Corianchirn sativum* L.). 5th International Crop Science Congress and Exhibition. Korea p.231.

Arit EO, Cattle LSF and Eur BT (2005). Effects of inter-planted Groundnut with Maize on Soil Organic Carbon and Yield of Maize. Soil Fert. Res., 16: 81-86.

Ayinde OE, Adewumi MO, Olatunji GB and Babalola OA (2010). Determination of Adoption of Downey Mildew Resistant Maize by Small-scale Farmer in Kwara State, Nigeria. Global J. Sci. Front. Res., 10(1): Pp 32-34.

Azeez JO and Adetunji MT (2003). Soya bean Performance with Nitrogen and Phosphorus in Tropical Soils. Moor J. Res., 4 (2): 170-177.

Central Bank of Nigeria (CBN) (1992). Annual Report and Statement of Accounts. Central Bank of Nigeria, Lagos. p. 78.

EL-Fattah Abd A, Selim EM and Awad EM (2012). Response of Com Plants (Zea mays) to Soil and Foliar Applications of Mineral Fertilizers under Clay Soil. J. Appl. Sci. Res., 8(8): 4711- 4719.

FAO (2008). What is food security? <http://www.fao.orglspfs>. (Accessed 10 September, 2010).

Havlin JL, James DB, Samuel LT and Wemer LN (2005). Soil Fertility and Fertilizers. An introduction to nutrient management (7 Edition). New Delhi 110020 p 391.

IITA (Interactional Institute of Tropical Agriculture) (2006). Maize overview In: Research in North Africa. Central Bank of Nigeria (CBN). Stat. Bull., 2003.

Kusimo FE (2004). Effects of inter-planted Sweet potato with maize and NPK Fertilization on Growth and yield of maize. Crop Science Research, 13: 18388. Int. J. Food and Agric., 5(3): 234 – 237.

Ling F and Silberbush M (2007). Response of Maize to Foliar Vs. Soil Application of Nitrogen-

Phosphorus-Potassium Fertilizers. J. Plant Nutr .,10(5): 2333-2342.

Mahmoodi P, Yarnia M, Amirnia R and Khorshidi MB (2011). Effect of nitrogen foliar application on grain filling rate and period in 3 cultivars of corn (*Zea mays* L.). Afr. J. Agric. Res., 6(29): 6226-6231.

Onwueme IC and Sinha TD (1991). Field Crop Production in Tropical Africa. Technical Centre for Agricultural and Rural Co-operation (CTA) the Netherlands, Pp.162.

Osagie AU and Eka OU (1998). Nutritional Quality of Plant Foods. Post-Harvest Research Unit, University of Benin, Benin. Pp. 34 - 41.

Pal UR and Murari K (1985). Length x Width Measurement for estimating leaf area. J. Agric. Res., Samaru. 3(12): 10 -12.

Rhesus PD (2006). Effects of Inter-planted Cover Crops with Maize on Soil Nutrient Status and Yield of Maize. Agric. Sci. J., 10(6): 205-210.

Wikipedia (2011). The Free Encyclopaedia the %20 Wikipedia the %20 free 20 Encyclopaedia http://en.wikipedia.org/wikilFoliar_feeding#Effectiveness.Foliar Feeding-Wekipedia. This page was last modified on 7th March 2012 at 23:17.

Yuncai Bur, Hucs Z and Schmidhalt U (2008). Effect of foliar fertilization application on the growth and mineral nutrient content of maize seedling under drought and salinity. J. Bot., 5(15): 1 747 - 1 765.